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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/773,510 | 02/02/2001 | Hirofumi Miyajima | 046124-5064 | 3311 |

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EXAMINER

MONDT, JOHANNES P

| | |
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| ART UNIT | PAPER NUMBER |
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2826

DATE MAILED: 08/29/2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/773,510

Applicant(s)

MIYAJIMA ET AL.

Examiner

Johannes P Mondt

Art Unit

2826

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) ____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3, 5 6) ☐ Other

DETAILED ACTION

Information Disclosure Statement

The examiner has considered the items listed in the Information Disclosure Statement of Paper No. 3 and the Supplemental Information Disclosure Statement of Paper No. 5.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 1-5** are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al (JP409102568A) over Zengerle (DE 3436545). Please be referred to Figure 6 in Hayashi et al. Hayashi et al teach a heat sink (cf. title) comprising:

a first planar member 34 having an upper face formed with a first groove portion 34a-34h (see section in full text marked [0039]);

a second planar member 33 having a face formed with a second groove portion 33a-33h (see [0039]); and

a partition 35 disposed between said upper face of said first planar member and said lower face of said second planar member 9 (see [0039]);

said partition being formed with a hole 35d (see also 2b on Figure 15) for communicating a first and a second space to each other (see [0039]), said first space being formed by said first groove portion and a lower space of said

partition, said second space being formed by said second groove portion and an upper face of said partition;

said heat sink further comprising a supply port 42d (see section [0047]) for supplying a fluid into said first space and a discharge port 43d (see section [0047]) for discharging said fluid from said second space.

Hayashi et al do not necessarily teach the further limitation that the face of said second planar member 33 that is formed with a second groove portion is a lower face. However, in substantially the same art, i.e., heat sink for liquid cooling of semiconductor devices, Zengerle teaches that, in order to increase the surface area over which heat can flow to the heat sink, - and thereby increase the efficiency of the heat sink, said heat sink with grooves should be arranged such that the grooves face the semiconductor components, thus enabling an improvement. Combined with the configuration as taught by Hayashi et al, straightforward implementation of this particular teaching by Zengerle would automatically lead to the device of claim 1.

Motivation to incorporate the teachings in this regard by Zengerle is the advantage of an increased capability of the heat sink to carry heat away from both planar members. All that is needed for combining the inventions in this regard is to apply the second groove portion to the *lower* face of planar member 33. Success in implementing the combination can therefore be reasonably expected.

With regard to claim 2: the upper face of said second planar member as taught by Hayashi et al has a heating element mounting area facing 14 for mounting a heating

element to be cooled, said hole being disposed position opposing (i.e., opposite) said heating element mounting area (see section [0019]).

With regard to claim 3: in the heat sink as taught by Hayashi et al a plurality of (said) holes are provided, namely 35a, 35b.

With regard to claim 4: the said hole 35b as taught by Hayashi et al has a cross section sufficiently small for injecting said fluid into said second space, because only a lower limit to the cross section is to be observed in this regard.

With regard to claim 5: the heat sink as taught by Hayashi et al has a guide piece 5 (cf. Figure 15) for restricting (that necessarily restricts) a direction in which said fluid is outputted from said hole to said second space, guide piece 5 being provided at an edge portion of said hole (35b, 2b) on said second space side.

3. **Claims 6-10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al and Zengerle as applied to claim 1 above, and further in view of Miyake (4,791,634). As detailed above, claim 1 (on which claim 6 depends) is unpatentable over Hayashi et al in view of Zengerle. Neither Hayashi et al nor Zengerle necessarily claim the further limitation of claim 6, although Zengerle specifically teaches a heat sink for liquid cooling of power semiconductor devices (cf. abstract and introduction on page 3, lines 17-20). However, the application of heat sinks to cool semiconductor laser apparatus has long been practiced in the art, as witnessed by Miyake, who teaches liquid-based cooling of a semiconductor laser diode array (cf. title, abstract and column 1, line 66 – column 2, line 5; and column 3, lines 18-21). Considering the teaching of

Hayashi et al and Zengerle, the heat sink according to claim 1 applied to a semiconductor laser apparatus mounted on an upper face of the second planar member is just a special case of the teaching of Hayashi et al and Zengerle of the heat sink of claim 1 as applied to a power semiconductor device as taught by Zengerle, while the special case of a semiconductor laser cooled by a heat sink based on liquid coolant has been taught by Miyake, hence long has been shown in the patent literature. Considering the power produced by semiconductor lasers ample *motivation* exists to specifically apply the invention essentially taught by Hayashi et al and Zengerle not just to power semiconductor devices but to semiconductor laser devices in particular. The teaching in this regard by Miyake *combines* readily with the invention by Hayashi et al and Zengerle by simple choice of device to be cooled. *Success* in combining the inventions in this regard can therefore *reasonably be expected*.

With regard to claim 7: said semiconductor laser as described by Miyake has a plurality of laser emission points arranged in a predetermined direction 46 (cf. column 4, lines 64-68 and Figure 3) so as to become substantially parallel to said upper face of the second planar member, being parallel to the upper face of any of the laser diodes. The said predetermined direction is obvious, because the laser light should not be directed to intersect with either the upper or lower face of any of the planar members.

With regard to claim 8: the invention by Miyake shows the semiconductor laser diodes to be stacked for obvious reasons of efficient use of space, comprising first and second heat sinks 104 and first and second semiconductor lasers 102 (cf. column 5, lines 33-42 and Figure 4). Applying the teaching in this regard and for the above

described reasons by Miyake to the invention essentially taught by Hayashi et al and Zengerle leads to a semiconductor laser stack apparatus comprising first and second heat sinks 104; and first and second semiconductor lasers 102; said first and second heat sinks being the heat sinks according to claim 1; said first semiconductor laser being held between an upper face of said second planar member of said first heat sink and a lower face of said first planar member of said second heat sink; said second semiconductor laser being mounted on said upper face of second planar member of said second heat sink.

With regard to claim 9: the semiconductor laser stack apparatus of claim 8, in particular with the stacking as taught by Miyake and the planar members and heat sinks as essentially taught by Hayashi et al and Zengerle, has a plurality of laser emission points arranged in a predetermined direction 46 (cf. column 4, lines 64-68 and Figure 3) oriented so as to become substantially parallel to said upper faces of first and second planar members for the obvious reason that the direction in which the light is emitted should not intersect with the upper or lower faces of said planar members.

With regard to claim 10: the semiconductor laser stack apparatus according to claim 8 further comprises:

a supply tube 48 connected to both of said supply port 42d of said first heat sink and said supply port of said second heat sink; and

a discharge tube 50 connected to both of said discharge port 43d of said first heat sink and said discharge port of said second heat sink,

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because said supply and discharge ports and tubes are taught by Hayashi et al for the individual heat sink, while the implementation of the teaching by Miyake obviously would imply the presence of said supply and discharge ports and tubes for all heat sinks in the semiconductor laser stack apparatus.

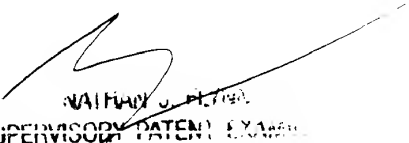
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P Mondt whose telephone number is 703-306-0531. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 703-308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

JPM
August 24, 2002


NATHAN J. FLYNN
SUPERVISOR, PATENT EXAMINER
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